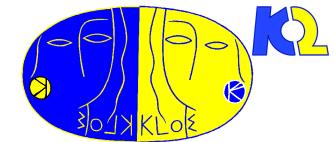

KLOE-2: run and end data-taking



Antonio Di Domenico
Dipartimento di Fisica, Sapienza Università di Roma
and INFN sezione di Roma, Italy

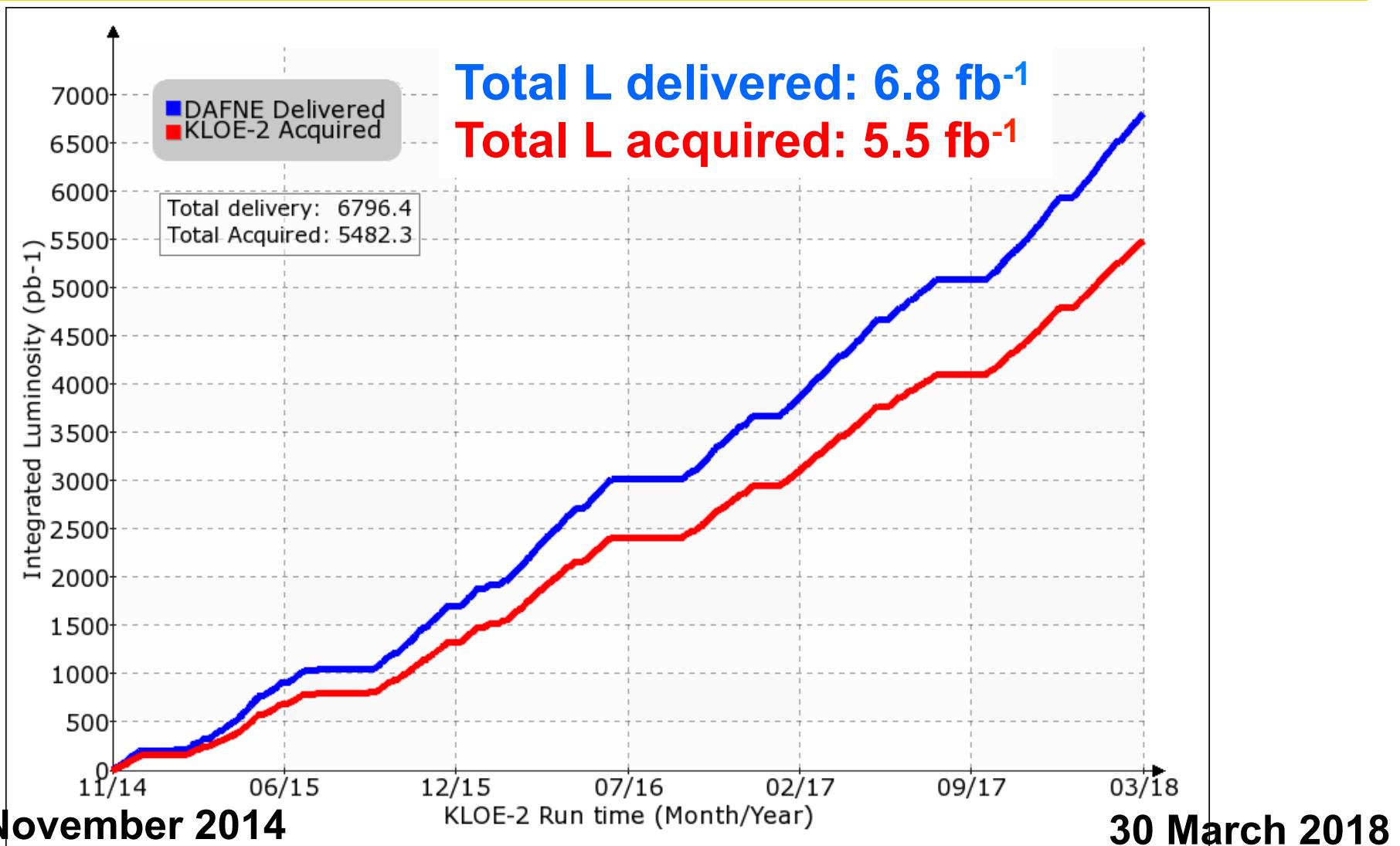


on behalf of the KLOE-2 collaboration



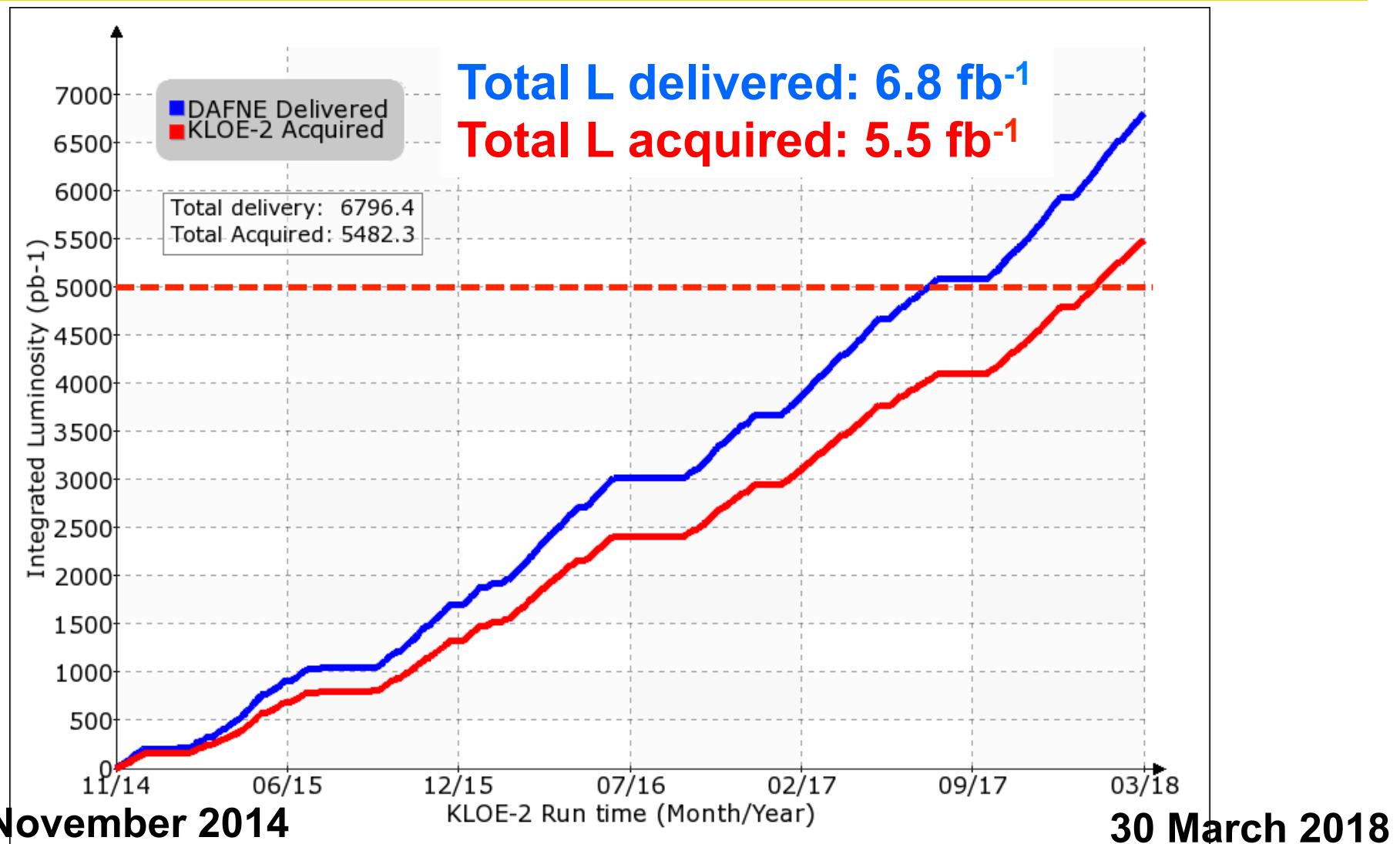
KLOE-2 data-taking closing ceremony
Frascati, 30 March 2018

KLOE-2 run



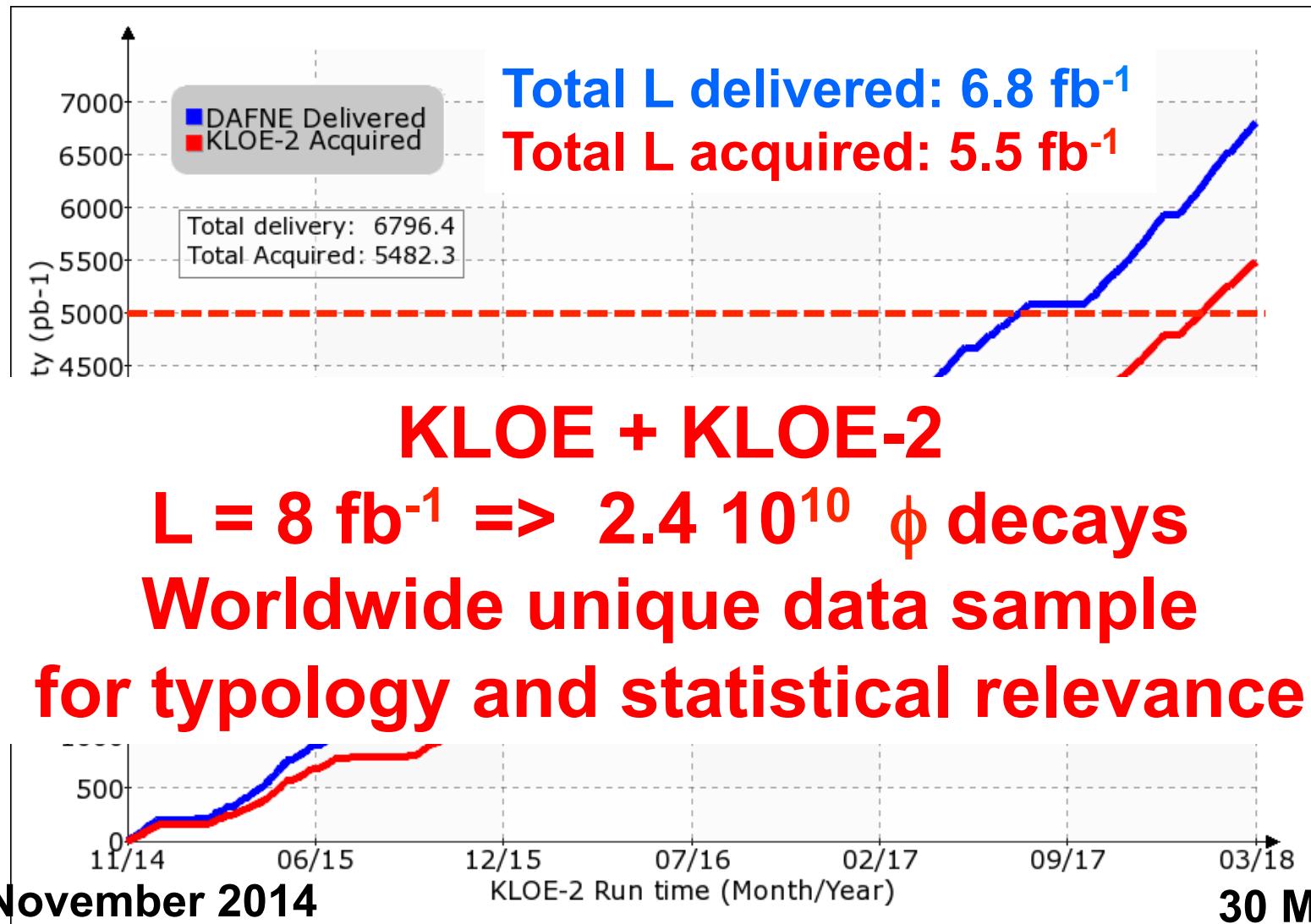
KLOE-2 goal: $L_{\text{acquired}} > 5 \text{ fb}^{-1} \Rightarrow L_{\text{delivered}} > \sim 6.2 \text{ fb}^{-1}$

KLOE-2 run



KLOE-2 goal: $L \text{ acquired} > 5 \text{ fb}^{-1} \Rightarrow L \text{ delivered} > \sim 6.2 \text{ fb}^{-1}$

KLOE-2 run



KLOE-2 goal: L acquired $> 5 \text{ fb}^{-1} \Rightarrow L$ delivered $> \sim 6.2 \text{ fb}^{-1}$

KAON Physics:

- CPT and QM tests with kaon interferometry
- Direct T and CPT tests using entanglement
- CP violation and CPT test:
 $K_S \rightarrow 3\pi^0$
direct measurement of $\text{Im}(\epsilon'/\epsilon)$ (lattice calc. improved)
- CKM Vus:
 K_S semileptonic decays and A_S (also CP and CPT test)
 $K\mu 3$ form factors, $Kl3$ radiative corrections
- $\chi pT : K_S \rightarrow \gamma\gamma$
- Search for rare K_S decays

Hadronic cross section

- Measurement of a_μ^{HLO} in the space-like region using Bhabha process
- ISR studies with 3π , 4π final states
- F_π with increased statistics

New proposal: running at $\sqrt{s} = 958$ MeV

- Production of Non-Vector-Resonances (η') in e^+e^- annihilation (η' TFF)

Dark forces:

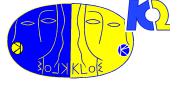
- Improve limits on:
 $U\gamma$ associate production
 $e^+e^- \rightarrow U\gamma \rightarrow \pi\pi\gamma, \mu\mu\gamma$
- Higgstrahlung
 $e^+e^- \rightarrow Uh' \rightarrow \mu^+\mu^- + \text{miss. energy}$
- Leptophobic B boson search
 $\phi \rightarrow \eta B, B \rightarrow \pi^0\gamma, \eta \rightarrow \gamma\gamma$
 $\eta \rightarrow B\gamma, B \rightarrow \pi^0\gamma, \eta \rightarrow \pi^0\gamma\gamma$
- **Search for U invisible decays**

Light meson Physics:

- η decays, ω decays, TFF $\phi \rightarrow \eta e^+e^-$
- C,P,CP violation:
improve limits on $\eta \rightarrow \gamma\gamma\gamma, \pi^+\pi^-, \pi^0\pi^0, \pi^0\pi^0\gamma$
- improve $\eta \rightarrow \pi^+\pi^- e^+e^-$
- $\chi pT : \eta \rightarrow \pi^0\gamma\gamma$
- Light scalar mesons: $\phi \rightarrow K_SK_S\gamma$
- $\gamma\gamma$ Physics: $\gamma\gamma \rightarrow \pi^0$ and π^0 TFF
- light-by-light scattering
- **axion-like particles** (new wrt K2 program EPJC (2010) 68, 619)

State of mind

Conclusions - II:



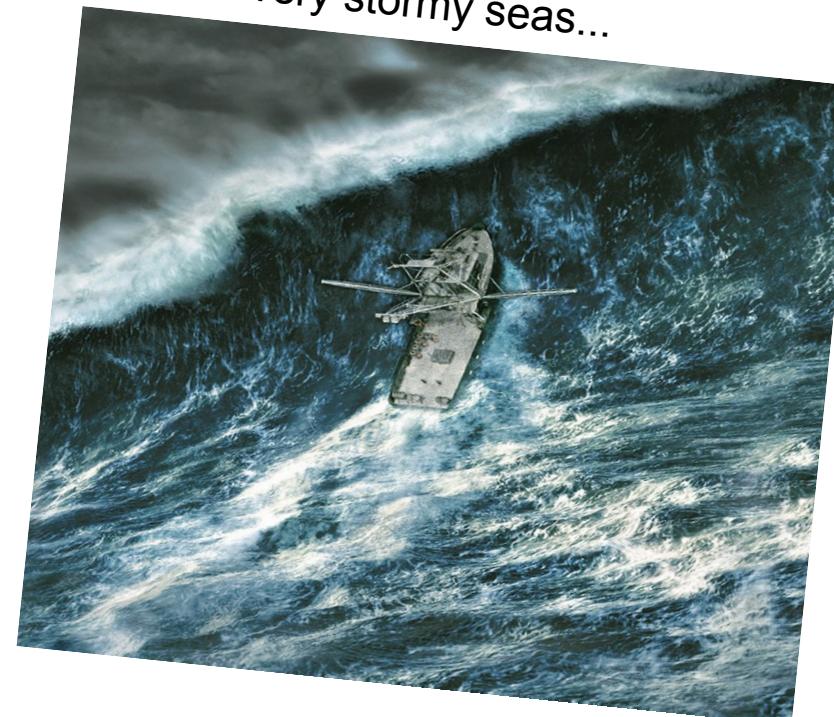
after 70 years from the first observation one might wonder whether investigations on kaons have exhausted the information that such relatively simple but rich system can provide:

I hope I convinced you that this is not the case....

...even though sometimes we are in very stormy seas...

...which require great perseverance, tenacity and patience to achieve the results.

A. Di Domenico



State of mind

Conclusions - II:



after 70 years from the first observation one might wonder whether investigations on kaons have exhausted the information that such relatively simple but rich system can provide:

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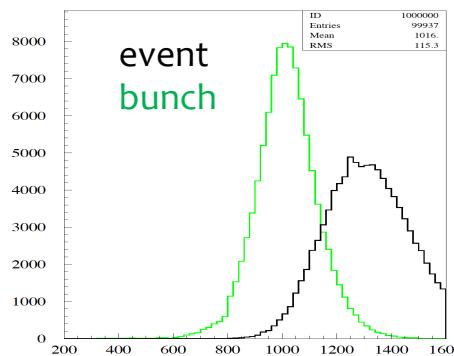


Understanding data and optimization of the run conditions

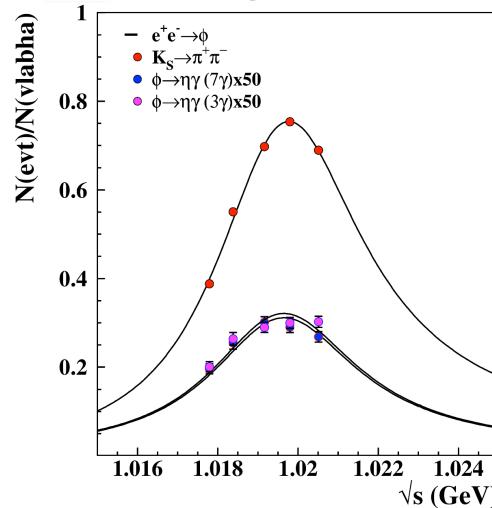


Data selection with “bunching”: reduction of machine background by selecting the bunch crossing in the event with TOF

Total EMC Bhabha energy



Energy scan

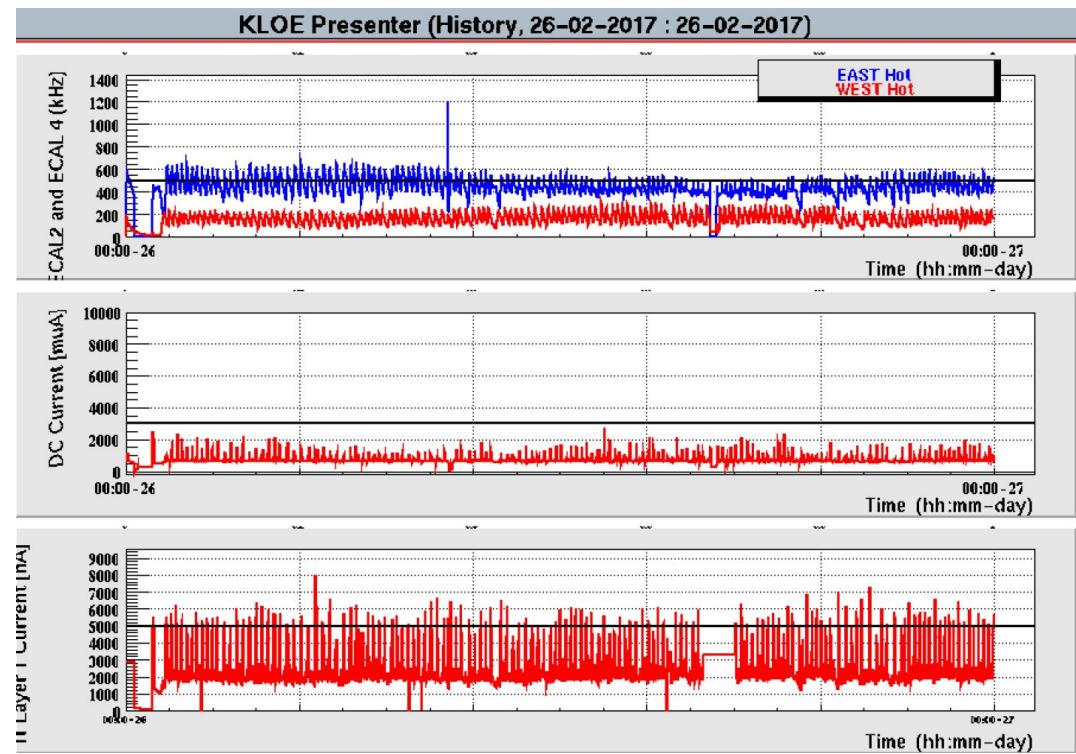


Conclusions:
KLOE absolute \sqrt{s} fine calibration: -240 keV
(after 10 years!)

DAFNE: \sqrt{s} has been shifted by +550 keV to run exactly on ϕ peak

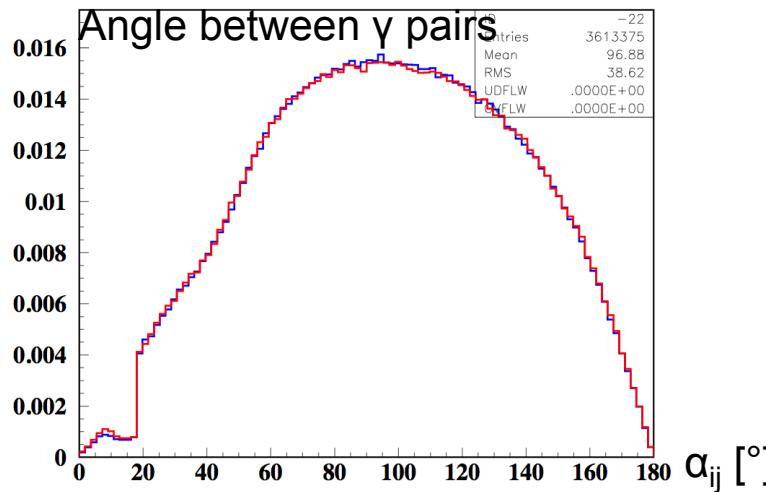
Provide online feedback information (EMC counts, DC and IT currents) to DAFNE to optimize beam injections (sinergy DAFNE-KLOE-2)

Hot End-caps counters ele < 500 kHz pos< 300 kHz
DC integrated current mostly < 2 mA
IT layer 1 integrated current mostly < 5 μ A

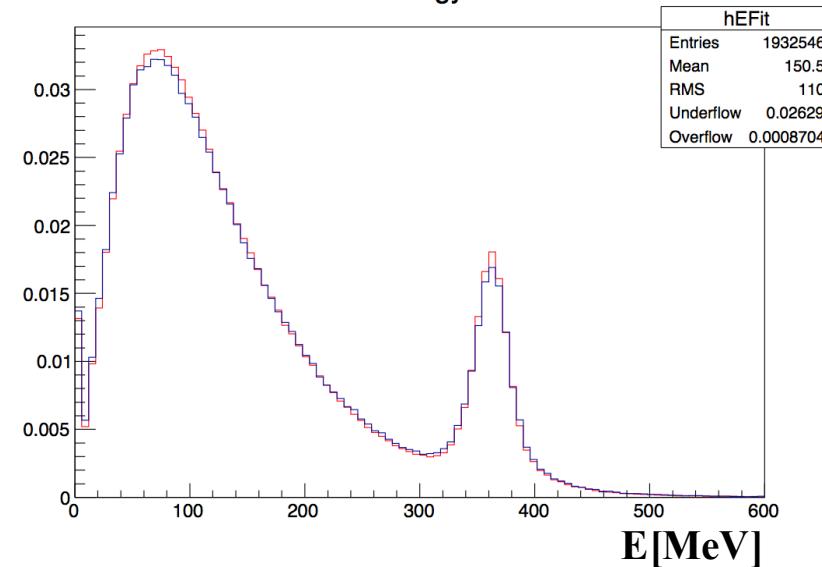


Data quality benchmark analyses

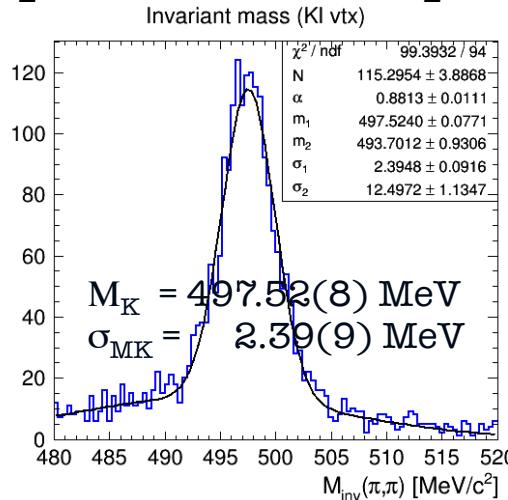
$\phi \rightarrow \eta\gamma$ with $\eta \rightarrow 3\pi^0$



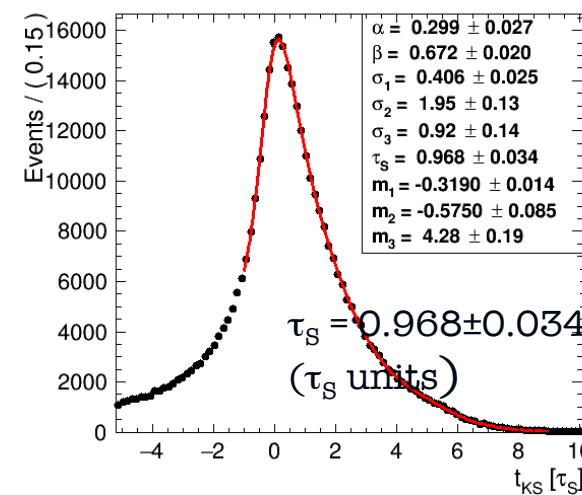
$\phi \rightarrow \eta\gamma$ with $\eta \rightarrow 3\pi^0$
Cluster energy after fit



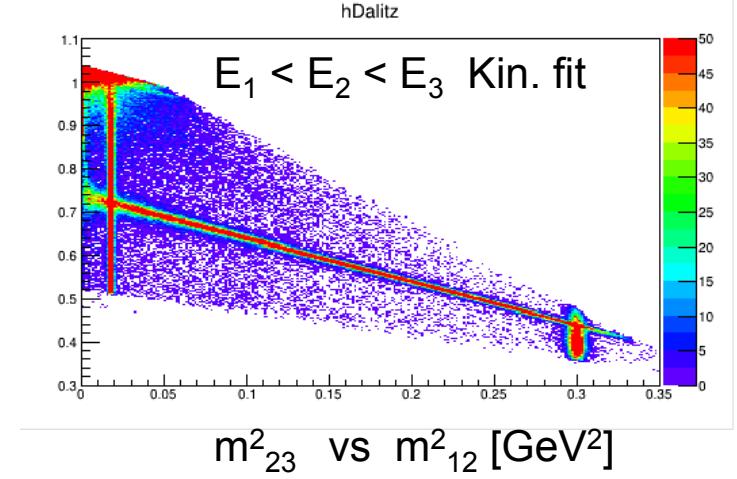
K_L inv mass with $K_L \rightarrow \pi^+\pi^-$



K_S lifetime with $K_S \rightarrow \pi^+\pi^-$

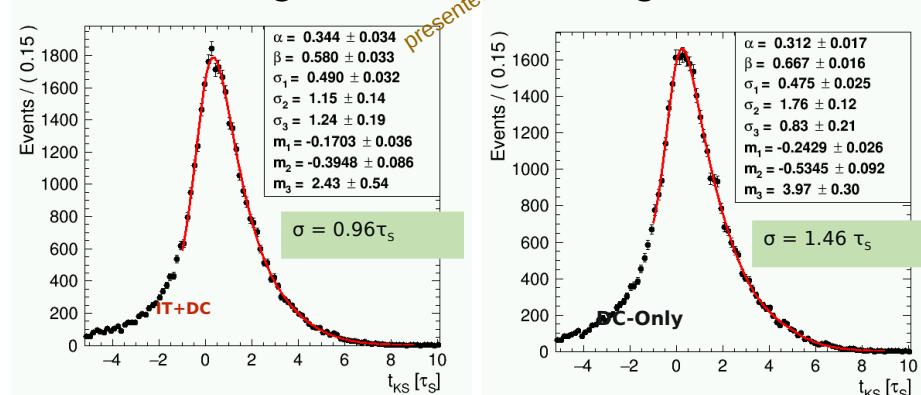


$\phi \rightarrow \eta\gamma$ with $\eta \rightarrow \gamma\gamma$



New detector analyses and computing facilities

K_S lifetime with $K_S \rightarrow \pi^+ \pi^-$



Search for $\gamma\gamma \rightarrow \pi^0$ with high-energy $\gamma\gamma$ taggers (HET)

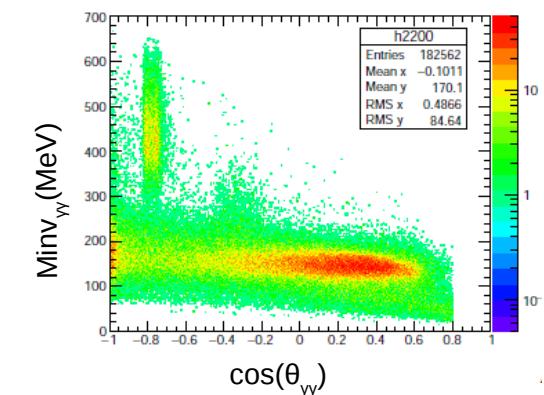
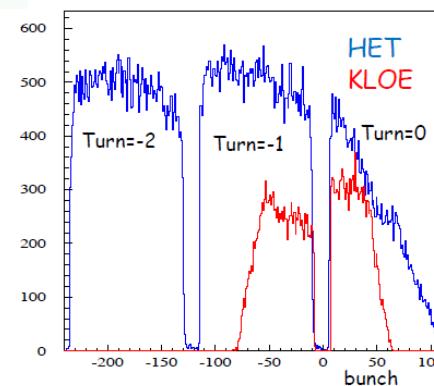
Analyses of Double-arm and Single-arm HET tagged events. Detailed beam transport studies performed. Characterization of background from data, MVA in progress.



Inner tracker:

successful alignment and calibration procedure
 K_S lifetime with KLOE-2 data with IT+DC integrated reconstruction.

Resolution from $1.5 \tau_S$ to $1 \tau_S$ using IT
 Expected improvement with refined Alig & Calib and optimized reconstruction



New TAPE LIBRARY IBM TS4500 R2
 Improved data-servers, new architecture with large disk array buffer, new GPFS protocol

Analysis never stops... latest results

<https://arxiv.org/abs/1711.03085>

PREPARED FOR SUBMISSION TO JHEP

In preparation

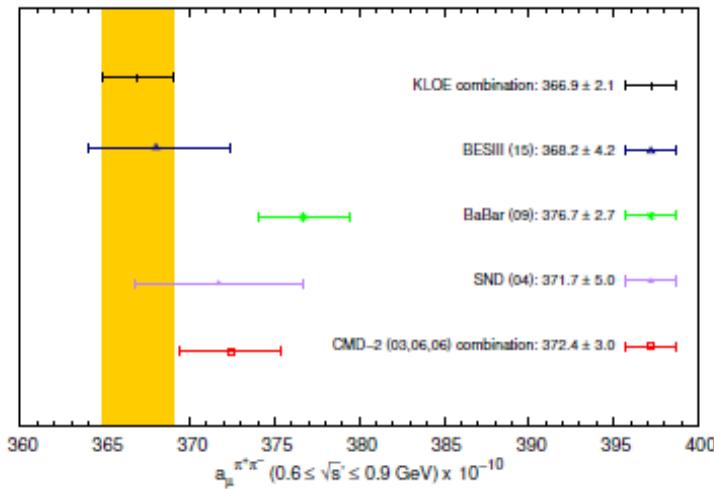
Combination of KLOE $\sigma(e^+e^- \rightarrow \pi^+\pi^-\gamma(\gamma))$ ISR measurements and $a_\mu^{\pi^+\pi^-}$ between $0.1 \leq s \leq 0.95$ GeV²

Accepted to JHEP

The KLOE-2 Collaboration

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 A. Budano^{s,t} L. Caldeira Balkestahl^w B. Cao^v F. Ceradini^{s,t} P. Ciambrone^d
 F. Curciarello^d E. Czerwiński^c G. D'Agostini^{j,p} E. Danè^d V. De Leo^r E. De I
 A. De Santis^d P. De Simone^d A. Di Cicco^{s,t} A. Di Domenico^{o,p} D. Domenic
 A. D'Uffizi^d A. Fantinij^{q,r} G. Fantinij^e P. Fermani^d S. Fiore^{u,p} A. Gajos^c P. Ga
 S. Giovannella^d E. Grazianiⁱ V. L. Ivanov^{h,i} T. Johansson^v D. Kisielewska-K
 X. L. Kang^d E. A. Kozyrev^{h,i} W. Krzemien^w A. Kupsc^v S. Loffredo^{s,t} P. A.
 G. Mandaglio^{g,b} M. Martini^{d,n} R. Messi^{q,r} S. Miscetti^d G. Morello^d D. Moric
 P. Moskal^c A. Passeriⁱ V. Patra^{m,p} E. Perez del Rio^d N. Raha^r P. Santang
 A. Selce^{s,t} M. Schioppa^{k,l} M. SilarSKI^c F. Sirghi^d E. P. Solodov^{h,i} L. Tortoraⁱ
 G. Venanzoni^{j,i} W. Wiślicki^w M. Wolke^v
 and

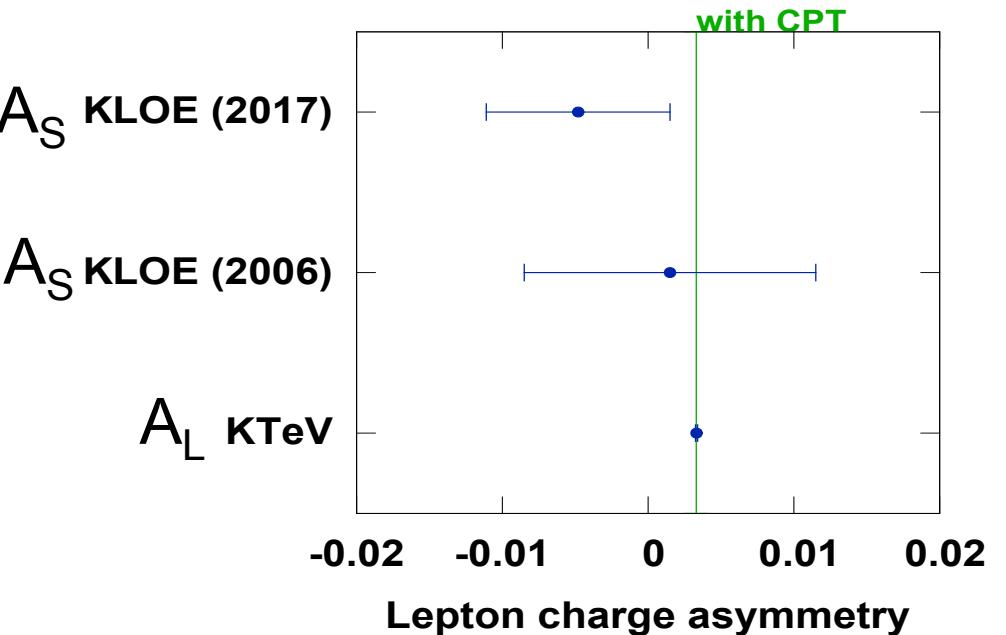
A. Keshavarzi^{x,1} S. E. Müller^y and T. Teubner^x



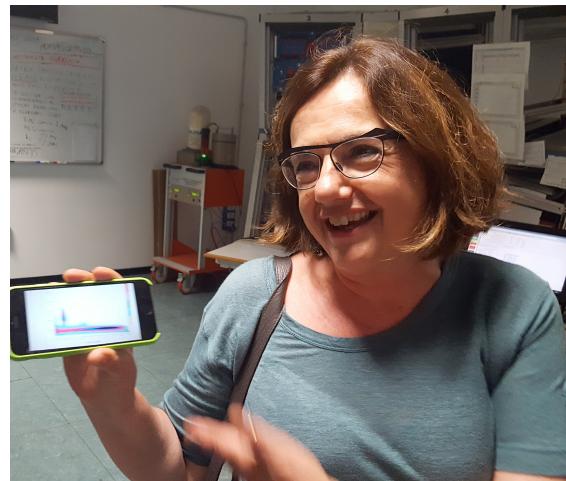
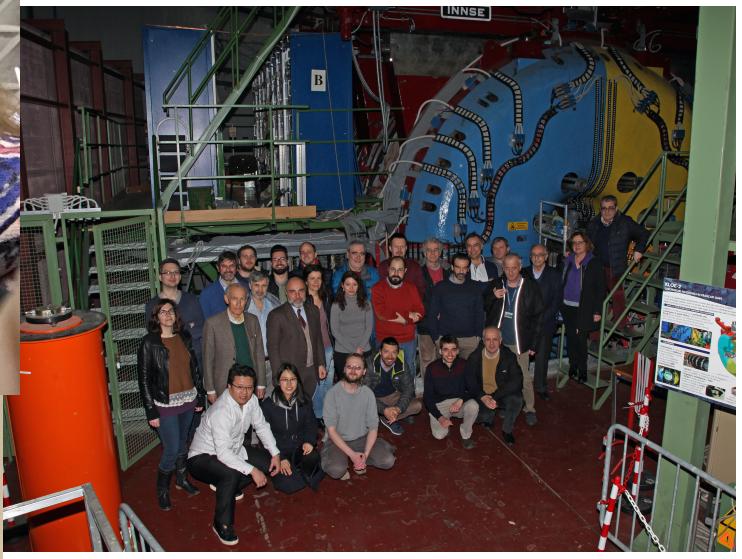
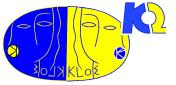
Measurement of the charge asymmetry for the $K_S \rightarrow \pi e \nu$ decay and test of CPT symmetry with the KLOE detector

The KLOE-2 Collaboration

A. Anastasi^{a,b} D. Babusci^b M. Berlowski^{b,c} C. Bloise^b F. Bossi^b P. Branchini^d
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 A. D'Uffizi^b A. Fantinij^{l,k} G. Fantinij^m P. Fermani^b S. Fiore^{n,i} A. Gajos^g P. Gauzzi^{h,i}
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 D. Kisielewska-Kamińska^g E. A. Kozyrev^{o,r} W. Krzemien^c A. Kupsc^f S. Loffredo^{e,d}



Thank you!



A. Di Domenico

KLOE-2 data-taking closing ceremony – 30th March 2018

Acknowledgements



Many thanks: to DAFNE team, accelerator, technical and research LNF divisions colleagues

to former KLOE and KLOE-2 colleagues

Many thanks to representative of the institutions that supported us along these years:

INFN President, INFN executive board, CSN-1 president and referees
LNF Director, Directors of INFN sections participating to KLOE-2
Former



Many thanks to Theorists who supported us since the beginning of the enterprise
Many thanks to All LNF personnel

Tribute to Paolo Franzini and Juliet Lee-Franzini



End of KLOE-2 data-taking at DAFNE

Connection with the KLOE-2 control room

